Employee Working Conditions and Healthcare System Performance: the Veterans Health Administration Experience

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Objective: *The authors explored the association between health care employees' perceptions of their organizations and objective measures of system performance.* ***Methods:*** *A national survey of employees conducted in 2001 by the Veterans Administration (VA) assessed employee perceptions of hospital organizational characteristics. The authors analyzed cross-sectional associations between these perceptions and objective measures of health care system performance—employee and patient care outcomes.* ***Results:*** *Employee perceptions of organizational climate (indicators of the organizational culture) were strongly related to overall satisfaction and measures of system performance. Overall, change in perceptions of organizational climate by 1 standard deviation (SD) was potentially associated with changes of 2% to 35% in selected outcomes.* ***Conclusions:*** *Organizational climate, policies, and resultant working conditions in health care institutions appear to be strong drivers of system performance. Interventions directed toward improving care quality and safety should address these factors.* (J Occup Environ Med. *2007;49:417–429*)

A national movement has recognized relationships between organizational characteristics, employee satisfaction and organizational perceptions, and outcomes important to employers, suggesting that higher employee satisfaction and more positive perceptions of the organization improve corporate performance.[1–3] Organizations such as Gallup[4] and collaborations of large employers[5] have invested heavily in instruments measuring employee perceptions to guide interventions. Beginning in the mid 1990s, the Health Enhancement Research Organization (HERO) has detailed relationships between employee satisfaction with health care benefits and both productivity and health care costs.[6,7] Improvements in important corporate outcomes documented by these and other initiatives include reduced sick time and compensation costs; improved productivity; reduced production errors, reductions in turnover, and associated costs; and improved quality and customer satisfaction.[6–10] Related to these classes of improvement, psychological research has linked "perceived organizational support" (POS)[11–13] to increases in employee motivation, productivity, and innovation.

Similar research in health care suggests that higher levels of employee stress are associated with higher levels of personal insurance costs,[14] decreased functional status,[15] medication errors, and malpractice.[10,16] Among physicians, reduced satisfaction is associated with riskier prescribing profiles, lower levels of compliance with

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treatment protocols, and reduced patient satisfaction.[17–21]

Two reports from the Institute of Medicine (IOM)[22,23] summarized evidence that human error and system failings contributed to adverse medical outcomes, documenting that health care organizational characteristics affect not just employees but also patients. The Baldrige 2003 Health Care Criteria of the Baldrige National Quality Program[24] recognizes these connections. Although health care, as an industry sector, relies heavily on technical systems, it is also a highly labor-intensive system. Improved working conditions, with improved employee perceptions of the organization and satisfaction, may therefore improve system performance to a greater degree than in more technology-intensive industries.

This core relationship between organizational characteristics and employee working conditions, as predictive of patient care outcomes, has received increased attention. A third IOM report[25] found that management practices, workforce capability, work design, and organizational safety culture have a strong impact on the work environment of nurses and thus on patient safety. A growing body of evidence documents that organizational climate and work organization (eg, choices in staffing ratios) affect working conditions, employee health, and patient outcomes. Examples include needlestick injuries and near-misses by hospital nurses[26]; nurse burnout, dissatisfaction, and increased patient deaths[27]; higher rates of patient infection, gastrointestinal bleeding, pneumonia, cardiac arrest, and death.[28]

The Veterans Health Administration (VHA), the largest integrated health care delivery system in North America, has demonstrated measurable improvements in quality and safety of care during the last decade and may provide lessons to guide other systems.[29–31] Therefore, the authors examined the cross-sectional relationships between employee perceptions of their organization, as measured in the 2001 system-wide All Employee Survey (AES), and employee- and patient-related outcomes, as measured by multiple administrative databases used within the VHA to monitor system performance.

The AES provides a quantitative assessment of organizational climate, defined as employee perceptions of the underlying organizational culture.[32] These measures thus represent indicators of the norms, values, and assumptions of the organization,[33] which are more accurately characterized by qualitative methods that were unavailable to this study.

The complexity of the phenomena addressed in this literature is reflected in the lack of agreement on key constructs and their interrelationships.[34,35] Several recent papers have been published that proposed taxonomies and theoretical models of the relationships between organizational characteristics, working conditions, and the quality and safety of patient care.[32,36] The lead author of our study participated in a paper that synthesized data from six AHRQ-funded projects on health care working conditions, to create a validated model of construct relationships.[36] The AES study detailed below was able to analyze constructs from all main dimensions of this proposed model: Core Structural Domains (leadership and structural characteristics) → Process Domains (supervision, work design, group processes, and quality emphasis) → Employee and Patient Outcomes. Using this model, the study team addressed three aims:

First, in the absence of primary data collection, the team sought to develop reliable measures of organizational climate using existing data.

Second, the team tested two basic hypotheses about the relationship between these measures of overall organizational climate and an array of outcomes measures: 1) positive employee perceptions of organizational climate are associated with higher employee satisfaction and health, and 2) positive employee perceptions of organizational climate are associated with better quality and safety of patient care.

Third, the team explored the hypothetical impact of standardized changes in these organizational climate measures on systems performance.

Materials and Methods

Survey Design, Administration, and Study Population

All self-report data for this study are from the All Employee Survey (AES) administered in 2001. All full- and part-time VHA employees were eligible to participate and received a copy of the survey in their mailboxes, to be mailed back to a contractor for scanning, data cleaning, and compilation. Contract employees, such as those working off-site in community-based outpatient clinics, house officers who are not paid through the VHA payroll system, and per diem nurses who were paid through an agency, were not eligible. Survey administrators circulated follow-up electronic notices, facility calls, and national hotline call reminders. Administration protocols did not include attempts at follow-up of nonresponders, because labor partners were concerned about possible coercion and inappropriate follow-up.

Survey Instrument: the 2001 All Employee Survey (AES)

Independent AES Variables

The organizational perception portion of the AES instrument used 94 items from two previously developed tools. The first was the Organizational Assessment Survey (OAS), developed by the Office of Personnel Management.[37] Response format for most of these items was a 5-point Likert scale, from "strongly disagree" to "strongly agree." Satisfaction questions used an analogous "very dissatisfied" to "very satisfied" format. Fourteen questions on job stress and working conditions (job demands, job control, role conflict,

social support, and safety climate) came from a National Institute for Occupational Safety and Health (NIOSH) instrument,[38] with a 4-point response format. All items and scales have been validated extensively by the source organizations. (Note that our study constitutes a further confirmatory analysis of the criterion validity of these measures.)

Work organization variables included hours of work, shift work, floating, mandatory overtime, and other scheduling variables from the Bureau of Labor Statistics Survey of Employment and a modified Federal Aviation Administration instrument. In these analyses, all except hours of work (three categories) were dichotomized at none versus any. Respondents also provided basic demographic information.

Dependent AES Variables

Attitudinal Outcomes. Overall satisfaction, assessment of patient care quality, stress, and turnover intention were categorical responses (a 5-point Likert scale).

Health and Safety Outcomes. Self-reported incidence of injuries (during the previous 12 months), exposure to bloodborne pathogens (BBP), verbal abuse, physical assault, and musculoskeletal pain was operationalized as dichotomous (none vs any) variables.

The AES is available from the authors.

Administrative VHA Data Sets: Facility-Level, Employee-Related, and Patient-Related Outcomes

Analyses could link employee organizational perceptions aggregated to the facility level with facility-level, employee-related, and patient-related outcome measures collected in other VHA administrative data sets, unrelated to the AES. These measures were carefully selected and constructed by the system. Because they constitute indicator variables on which facility performance is rated and compared, reliability and validity are tested extensively and reviewed within the system. But, although considered valid for use in assessing facility performance, they are subject to a certain amount of "noise" related to potential differences in rigor of data collection, reporting, and follow-up. Also, note that "facility" in the VHA does not usually mean a single building or location but refers to a parent hospital, or an administratively merged set of hospitals, and all associated care-provision entities. Analyses used the 141 facilities that could be compared across databases.

The administrative databases selected for this study were chosen based on two criteria: 1) there was a reasonable probability that the measures would be affected by organizational climate, and 2) the quality of data was robust and not easily affected by conscious efforts of reporting personnel to improve a facility profile.

Employee-Related Administrative Databases. Three different databases were linked with the facility-level AES data, all reported as rates (per 100 FTEE [Full Time Equivalent Employee]): sick leave for both nonclinical and clinical (ie, doctors, nurses, etc) employees; lost time claims rate (LTCR), from the Workers' Compensation Management Information System, an internal VHA data system using Department of Labor data; and Equal Employment Opportunity (EEO) complaint rates. The study only analyzed formal claims, cases that proceeded to formal adjudication by the Office of Resolution Management in the Department of Veterans Affairs.

Patient-Related and Care-Related Administrative Databases. Four databases provided outcome data for the analyses.

Inpatient and Outpatient Satisfaction. The VHA Office of Quality and Performance queries a stratified random sample of patients on detailed aspects of satisfaction with inpatient and outpatient care. Our analyses used facility means of an overall satisfaction item for both (theoretical range: 0% to 100%).[39]

Clinical Quality of Preventive and Chronic Care. Measurements of clinical quality of care rely on the External Peer Review Program (EPRP)[40] evaluations of the Clinical Practice Guidelines. They are reported as the percentage of time that a facility implemented all recommended measures or achieved particular clinical outcomes for a particular condition.

These EPRP measures, developed over the last 20 years, are accepted measures of quality and are used routinely for monitoring quality of care and comparing health care organizations. Initial measures for outpatient care quality were aligned with the HEDIS (Health Plan Employer Data and Information Set), developed by the National Center for Quality Assurance as a tool to compare managed care plans. Many of the inpatient measures are required by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and are now vetted through the National Quality Forum.[41] The EPRP developed as a formal approach to abstracting data on adherence to clinical practice guidelines. The data are used for three separate VHA goals: care quality evaluation; information feedback to providers on their adherence to clinical practice guidelines; and system performance management, including management rewards. The measures have obvious face validity, as they represent evidence-based standards of medical practice. As importantly, there is evidence that they lead to improved outcomes.[42] These measures have recently been used to compare quality of care in both outpatient[29,31] and inpatient[43] settings.

From a wide range of EPRP measures, we selected three: management of two chronic diseases (diabetes and chronic obstructive pulmonary disease [COPD]); and the Prevention Index, a summary measure of preventive care delivery. The Prevention Index calculates how closely

VA preventative care follows national standards of care according to national indicators (vaccination, tobacco prevention, disease, and risk factors screening). Selection of these three measures was based on two criteria: 1) they require a coordinated, systems response from the facility and are thus assumed to be sensitive to the overall facility climate, and 2) they have sufficiently high prevalence across the system to provide comparisons among all 141 facilities.

Surgical Outcomes. The National Surgical Quality Improvement Program (NSQIP)[44] measures observed and expected postsurgical mortality and morbidity, after adjusting for major known comorbidity factors. Facility scores are risk-adjusted for regional variations in patient characteristics and complexity of facility procedures. The program is used routinely throughout the VHA system to assess quality and safety of surgical care; its validity and reliability have been tested rigorously through individual site visits by the development team.[44,45]

Cost Per Unique Patient. Cost (in dollars) per unique patient is one measure of organizational success and represents the single most important factor on which Congress rates the VHA. These data are adjusted for diagnostic code group (ie, a 5-step case-mix severity adjustment, to reflect the increased costs for more complex patient care).[46] In addition, to allow direct comparison, these measures are adjusted for the cost of living and medical care in the local area for each facility.

Data Analysis

Individual-Level Analyses. SPSS version 11 (SPSS, Chicago, IL) was used for all data analyses. Individual-level analyses were only used to identify constructs and assess scale reliability. Factor analysis of the 94 organizational perception items in the AES (SPSS: principal components extraction, Varimax rotation) was used to identify factors with eigenvalues of >1.0. Factor scores used were the mean value of component items. Cronbach-alpha statistics were calculated at the individual level to quantify the reliability of each scale.

Facility-Level Analyses. The individual-level organizational climate factor scores, aggregated to mean values for each facility, were entered as independent variables in facility-level multivariate linear regression models to explain variance in outcome measures, both derived from the survey and from the administrative data sets. Covariates consisted of facility response rate, facility size, and the measures of work organization. All models used forward stepwise entry ($P = 0.05$ for entry, 1.0 for removal), with independent variables hierarchically entered in blocks (1 = facility size and response rate; 2 = work organization variables; 3 = organizational climate factors). Based on the unacceptable level of collinearity among the initial organizational climate variables (analyzed with SPSS collinearity diagnostics), these factor scores were entered into a second-order factor analysis that generated 4 independent variables—"climate metafactors" used in final, facility-level modeling.

Although the hypotheses of the study and the AES questions are phrased in terms of overall organizational climate, rather than local, workgroup, or service line climate, the large difference in response rate between administrative and nonadministrative personnel warranted a comparison of models built for these populations.

To quantify potential consequences for system performance of poor perceived organizational climate, the study team built models to estimate improvement in the outcome measures associated with a 1 SD improvement in each of the organizational climate metafactors. A sum change associated with a 1 SD improvement in all four metafactors was calculated and converted to a total theoretical percentage change in each outcome variable.

Results

Between October 15, 2001 and November 26, 2001, 74,662 employees from an estimated total 200,397 returned surveys, for an overall response rate of 37%, with a range by facility from 9% to 92%. More than 70% of administrative and about 33% of clinical, clerical, technical, and wage-grade staff responded.

Aim 1: Develop Reliable Measures of Organizational Climate Using Existing Data

Individual-level exploratory factor analysis identified 19 constructs as measures of organizational climate (independent variables). Four more perception factors served as attitudinal outcome (dependent) variables: 1) overall employee satisfaction, 2) perceived quality of care, 3) stress, and 4) turnover intention. Table 1 describes characteristics of these constructs and specifies their links to the three major domains and eight component constructs of the AHRQ theoretical model[36] presented in the Introduction.

Because of the strong collinearity at the facility level among these 19 independent measures, regression analyses were unable to develop stable models. At the facility level, the second-order exploratory factor analysis of the 19 climate factors reduced these data to four constructs referred to as "climate metafactors" (Table 1, last column). The first of these, labeled "Employee Focus," explaining 48% of the total variance in all 19 factors, collected 13 of the first-order climate factors (Cronbach $\alpha = 0.931$). This metafactor combines constructs from both the Core Structural and the Process domains of the AHRQ theoretical model,[36] emphasizing broad leadership aspects of the organization. The second metafactor, explaining 15% of variance, collects three climate factors relating to the group processes and supervision constructs of the AHRQ Process domain. These constitute an interpersonal metafactor, labeled "Support"

TABLE 1
AES Measures: Individual Level Factors, Reliability, Relationship to the AHRQ Theoretical Model,[36] and Composition of Four Second-Order "Climate Metafactors" Derived at the Facility Level Employee Working Conditions and Healthcare System Performance: the VHA Experience

	Number of Items	Cronbach Alpha	AHRQ Model Domain	Four Climate Metafactors (Facility Level)
Organizational Climate Factors (Individual Level)				
1. Leadership	9	0.9295	Leadership	Employee focus
2. Resources	9	0.8630	Structural	Employee focus
3. Rewards and recognition	6	0.8594	Leadership	Employee focus
4. Planning and evaluation	6	0.8203	Leadership	Employee focus
5. Employee development	5	0.8526	Leadership	Employee focus
6. Cooperation	4	0.8299	Group Processes	Employee focus
7. Supervisory support	4	0.8935	Supervision	Employee focus
8. Innovation	5	0.8935	Quality Emphasis	Employee focus
9. Customer service	3	0.8195	Quality Emphasis	Employee focus
10. Conflict resolution	2	0.7964	Supervision	Employee focus
11. Change assistance	2	0.7184	Leadership	Employee focus
12. Job control	3	0.7834	Work Design	Employee focus
13. Safety climate	4	0.8823	Work Design	Employee focus
14. Coworker support	2	0.7460	Group Processes	Support
15. Diversity acceptance	6	0.8890	Group Processes	Support
16. Work and family balance	3	0.5740	Supervision	Support
17. Role conflict	2	0.3243	Work Design	Professional demands
18. Job demands	3	0.7436	Work Design	Professional demands
19. Pay satisfaction	Single item	—	Structural	Pay satisfaction
Outcome Scales				
1. Overall satisfaction	4	0.7859	Employee	(Separate outcome)
2. Care quality	2	0.7523	Patient	(Separate outcome)
3. Stress	2	0.8424	Employee	(Separate outcome)
4. Turnover intention	2	0.6814	Employee	(Separate outcome)

(Cronbach $\alpha = 0.655$). The third, here called "Professional Demands" (Cronbach $\alpha = 0.501$) and accounting for 12% of the variance, consists of two factors relating to the work design construct of the AHRQ Process domain—job demands and role conflict, elements of traditional "work stress" models. Higher scores on this factor represent more challenging work (ie, higher stress levels by traditional models). Employee Focus and Professional Demands were negatively correlated ($r = -0.3$; $P < 0.0001$). Finally, "Pay Satisfaction" remained as a single, separate item, explaining 6% of the variance. Pay structure is seen as an important representative of the Structure domain in the AHRQ model.

Reliability of the initial individual-level factors was high, with the exception of two. Although the second-order analysis was necessary for the reduction of multicollinearity, note that the reliability statistics of Support and Professional Demands are low.

Aim 2: Test the Hypotheses About the Associations Between Organizational Climate Measures and Outcomes Measures

Facility response rate was positively correlated with Employee Focus ($r = 0.31$) and Support ($r = 0.19$) but not with Professional Demands or Pay Satisfaction. By contrast, facility size was negatively correlated with Support, Professional Demands, and Pay Satisfaction ($r = -0.23$, -0.48, and -0.37, respectively) but was not correlated with Employee Focus scores. These associations made it prudent to adjust for facility response rate and employee population in regression analyses.

Table 2 presents the descriptives at the facility level for all survey-derived and administrative variables analyzed in these models. All AES categorical perception variables were aggregated to continuous variables by scale creation and facility aggregation; means, SDs, and range are presented. Trichotomous (work hours) and dichotomous AES work organization and outcome variables are reported as percentages in each category, over the 141 VHA facilities. Overall, 23% of responding employees did some form of shift work (range over 141 facilities: 5% to 38%), and 11% floated between units (range: 3% to 21%). Otherwise, the prevalence of potentially negative work organization variables was low (0.2% to 6%) but characterized by wide variation among facilities.

Table 3, which consists of the facility-level standardized regression results, reports the associations of the four self-reported employee climate metafactors and work organization covariates with outcomes derived

TABLE 2
Facility Level 2001 Measures (n = 141): Descriptives for all AES (All Employee Survey) Variables and Outcomes From Administrative Databases

Categorical Variables	Yes	No
Work organization variables (independent; AES)		
Hours worked/2 wk (trichotomous)		
<80		15%
80		69%
>80		16%
Dichotomous variables (% yes/no)		
Off-shifts; no rotation	23%	77%
2-shift rotations	3%	97%
3-shift rotations	2%	98%
Split and partial shifts	0.2%	99.8%
Frequent floating to other units	11%	89%
Frequent shift switching	3%	97%
Frequent mandatory overtime	6%	94%
Health and safety outcomes (dependent; AES)		
Any work-related injury in last year	17%	83%
Any bloodborne pathogen exposure in last year	24%	76%
Any verbal abuse in last year	65%	35%
Any assault in last year	13%	87%
Any unreported musculoskeletal pain in last year	19%	81%

Continuous Variables		Mean	SD	Min.	Max.
Climate metafactors (independent; AES)					
Employee focus	(possible range: 1–5)	3.07	0.11	2.77	3.40
Support	(possible range: 1–5)	3.28	0.10	3.04	3.51
Professional demands	(possible range: 1–4)	2.79	0.08	2.63	3.01
Pay satisfaction	(possible range: 1–5)	3.02	0.17	2.60	3.41
Employee reported outcomes (dependent; AES)					
Overall satisfaction	(possible range: 1–5)	3.56	0.13	3.14	3.84
Care quality	(possible range: 1–5)	4.18	0.13	3.84	4.51
Stress	(possible range: 1–5)	3.30	0.12	3.08	3.63
Turnover intention	(possible range: 1–5)	3.58	0.16	3.08	3.96
Employee-related outcomes (dependent; admin. databases)					
Clinical sick leave rate	hrs/100 FTEE	21.2	11.0	2.02	77.4
Non-clinical sick leave rate	hrs/100 FTEE	5375.00	649.00	3597.00	7844.00
Lost time claims rate	claims/100 FTEE	2.95	1.31	0.41	9.07
Equal Employment Opportunity Claims	claims/100 FTEE	0.90	0.71	0.00	3.71
Patient-related outcomes (dependent; admin. databases)					
Inpatient satisfaction	(possible range: 0%–100%)	67.6	8.5	44.0	89.0
Outpatient satisfaction	(possible range: 0%–100%)	64.0	6.6	27.0	76.0
EPRP: Prevention index	(possible range: 0%–100%)	79.8	5.8	59.3	91.1
EPRP: COPD management	(possible range: 0%–100%)	72.9	6.1	53.9	86.5
EPRP: Diabetes exams	(possible range: 0%–100%)	79.4	7.4	50.4	92.9
Postsurgical mortality; observed/expected		0.95	0.43	0	2.65
Cost per unique patient (in dollars)		4100.00	752.00	2457.00	6302.00

SD indicates standard deviation; FTEE, full-time employee equivalent; EPRP, External Peer Review Program; COPD: chronic obstructive pulmonary disease.

from the AES and from administrative data, adjusting for the size of the facility and rates of response. The table presents adjusted R^2 values for blocks 1 and 2 (size, response rate, and work organization variables) together, then block 3 (the four employee-reported climate metafactors) with R^2 change calculated.

Because of a substantial difference in rates of response between administrative and nonadministrative employees, these models were created for the entire AES data set and for

TABLE 3
Facility Level Regression Models ($n = 141$). Significant ($P \leq 0.05$) Linear Regression Coefficients, adj. R^2 Values, and R^2 Change

	Survey Outcomes:								
	Attitudinal				Health and Safety				
	Overall Satisfaction	Care Quality	Stress	Turnover Intention	Any Work-Related Injury	Any Bloodborne Pathogen Exposure	Any Verbal Abuse	Any Assault	Any Unreported Musculoskeletal Pain
Blocks 1 and 2 (facility size, response rate, work organization)									
Facility size: FTEEs	−0.181	−0.124				0.182			
Response rate	0.081								
Hours worked/2 wk							0.298	0.160	
Off-shifts; no rotation					0.227	0.217		0.548	
2-shift rotations						0.212			
3-shift rotations									
Split and partial shifts				0.216					
Floating to other units									
Shift switching									
Mandatory overtime									
R^2 blocks 1 and 2	**0.219**	**0.312**	**0.246**	**0.078**	**0.092**	**0.164**	**0.127**	**0.330**	**0.046**
Block 3: Organizational climate									
Employee focus	0.721	0.304	−0.163				−0.295	−0.204	
Support		0.533		−0.209	−0.246				−0.328
Professional demands	−0.144		0.710						
Pay satisfaction	0.233		0.151	−0.602					
R^2 add organizational perceptions	**0.798**	**0.712**	**0.636**	**0.483**	**0.140**	**0.164**	**0.197**	**0.362**	**0.129**
Change in R^2	0.579	0.400	0.390	0.405	0.048	0	0.070	0.032	0.083

(Continued)

FTEE indicates full-time employee equivalents. This rough measure of facility size underestimates the actual number of part-time employees.

TABLE 3
(Continued)

	Administrative Databases										
	Employee Related				Patient Related						
	Clinical Sick Leave Rate	Nonclinical Sick Leave Rate	Lost Time Claims Rate	Equal Employment Opportunity Claims Rate	Inpatient Satisfaction	Outpatient Satisfaction	EPRP: Prevention Index	EPRP: COPD Mgmt.	EPRP: Diabetes Exams	Postsurgical Mortality; Observed/ Expected	Cost per Unique Patient
Blocks 1 and 2 (facility size, response rate, work organization)											
Facility size: FTEEs							−0.239				0.337
Response rate			−0.227								−0.183
Hours worked/2 wk											−0.245
Off-shifts; no rotation	−0.315										
2-shift rotations								0.181			
3-shift rotations									0.258		
Split and partial shifts											
Floating to other units	0.311				−0.215			−0.216		−0.274	−0.207
Shift switching										0.345	
Mandatory overtime			0.236	−0.279				0.259			
R^2 blocks 1 and 2	**0.119**	**0.281**	**0.083**	**0.110**	**0.247**	**0.097**	**0.052**	**0.106**	**0.049**	**0.108**	**0.271**
Block 3: Organizational climate											
Employee focus							0.219	0.380	0.273		
Support		−0.356		−0.448	0.369	0.498					
Professional demands		−0.169			0.196						
Pay satisfaction											
R^2 add organizational perceptions	**0.161**	**0.392**	**0.083**	**0.259**	**0.348**	**0.283**	**0.093**	**0.225**	**0.112**	**0.108**	**0.271**
Change in R^2	0.042	0.111	0	0.149	0.101	0.186	0.041	0.119	0.063	0	0

the subset of employees directly related to clinical care (n = 32,742). There were no large differences in the results of these models; the study team did not pursue this distinction in subsequent modeling.

Hypothesis 1a: Employee-Reported (Survey) Attitudinal Outcomes. Models explaining variance in the four attitudinal outcomes (AES reports of satisfaction, overall quality, stress, and turnover intention) did not show significant entries for most work organization variables. The size of the facility was negatively associated with overall satisfaction and care quality perceptions. In these attitudinal models, the employee-reported climate metafactors explained far more variance, with R^2 values generally greater than 0.6. Employee Focus, Support, and Pay Satisfaction are positively associated with positive outcomes, while Professional Demands are negatively associated with these outcomes. Employee Focus is most strongly associated with overall employee satisfaction, while the Support construct is most strongly associated with perceptions of care quality. Professional Demands are most strongly related to increased reports of stress, while Pay Satisfaction is the strongest driver of reduced turnover intention. There is also a positive, but weaker, association between Pay Satisfaction and stress.

Hypothesis 1b (Survey Data): Employee-Reported Health and Safety Outcomes. In contrast to models built to explain variance in the four attitudinal outcomes, five employee-reported measures of occupational health and safety outcomes were primarily related to work organization variables, in particular, shift work and hours of work, with facility size also being associated with increased reports of exposure to bloodborne pathogens. There is a particularly strong association of shift work with assault rate. However, Employee Focus has moderately strong associations with reduced verbal abuse and assaults, and Support is associated with reductions in work-related injuries and musculoskeletal pain.

Hypothesis 1b (Administrative Data): Employee-Related Outcomes. Sick time models for clinical and nonclinical personnel show diametrically opposed results. Clinical sick time is influenced primarily by work organization variables: floating is associated with increased clinical sick time, and shift work is associated with reductions in sick time. Only one climate metafactor (Pay Satisfaction) is related to reduction in clinical sick leave. In contrast, nonclinical sick time is unrelated to work organization constructs, is increased in larger facilities, and has a negative association with Employee Focus, Support, and Professional Demands.

The 2001 lost time claims rate was associated only with mandatory overtime (positive association), but formal Equal Employment Opportunity (EEO) claims are negatively associated with mandatory overtime. There is a strong negative association between formal EEO claims and the Support climate metafactor.

Hypothesis 2: Patient-Related Outcomes: Administrative. The last seven columns of Table 3 quantify the contribution of the four climate metafactors and covariates to explaining variance in patient-related outcomes from the administrative databases. Patient satisfaction demonstrates the strongest connection with the climate metafactors, while being unrelated to all covariates except floating to other units (associated with reduced inpatient satisfaction). While increases in both inpatient and outpatient satisfaction are strongly related to increased levels of Support, increased inpatient satisfaction is also associated with higher levels of Professional Demands.

All three External Peer Review Program (EPRP) measures of clinical performance are higher in facilities reporting higher levels of Employee Focus, with shift work and overtime variables having a particular effect on management of COPD. Hypothesized negative characteristics of work organization were associated with improved COPD and diabetes management, but the primary driver is the Employee Focus construct.

The other patient-related measures are not significantly associated with the climate metafactors but are related to the covariates. The post-surgical mortality observed and expected ratio is lower in facilities with higher rates of floating to other units, but it is elevated in facilities that utilize shift switching. Cost/Unique Patient is associated with longer work hours and floating to other units; this cost is also increased in larger facilities but negatively associated with the facility response rate.

Aim 3: Explore the Hypothetical Impact of Change in Organizational Climate Measures on Systems Performance

In Table 4, we calculated the potential consequences for system performance measures of a 1 SD scale change in each of the four employee-reported climate metafactors. This is equivalent to 8% to 17% (depending on the metafactor SD) of employees in a facility changing their ratings by one of the five survey scale response points. Columns 4 through 7 report the changes in the mean of each outcome variable associated with a 1 SD change in that climate metafactor. These changes are summed in column 8 and expressed as a percent change in column 9. Organizational initiatives that would improve aggregate employee perceptions 1 SD might theoretically have the consequences shown in Table 4, with caveats outlined in the discussion.

Discussion

Aim 1 of the study was partly accomplished; the study team was able to develop measures of organizational climate from the existing AES data. The reliability of most individual-level scales was high, but the reliability of the four climate metafactors developed at the facility

TABLE 4
Potential System Consequences of a One Standard Deviation (SD) Improvement in Each of the Four "Climate Metafactors" (Controlling for Possible Changes in Work Organization)

	Descriptives of Outcome Measures		Change in Outcome					
	Mean	SD	If 1 SD Change in Employee Focus	If 1 SD Change in Support	If 1 SD Change in Demands	If 1 SD Change in Pay Satisfaction	Total Change in Outcome	% Change in Outcome
Employee-related outcomes								
Clinical sick leave rate (hrs/100 FTE)	21.2	11.0	0.0	0.0	0.0	−1.903	−1.90	−9.0%
Nonclinical sick leave rate (hrs/100 FTE)	5375.0	649.0	−184.0	−123.0	−188.0	0.0	−495.0	−9.2%
Lost time claims rate/100 FTEE	2.95	1.31	0.0	0.0	0.0	0.0	0.00	0.0%
Formal EEO complaints/100 FTE	0.9	0.71	0.0	−0.32	0.0	0.0	−0.32	−35.3%
Patient-related outcomes								
Inpatient satisfaction (%)	67.6	8.5	0.0	3.52	1.71	0.0	5.23	7.7%
Outpatient satisfaction (%)	64.0	6.6	0.0	3.40	0.0	0.0	3.40	5.3%
EPRP: Prevention index (%)	79.8	5.8	1.27	0.0	0.0	0.0	1.27	1.6%
EPRP: COPD management (%)	72.9	6.1	2.32	0.0	0.0	0.0	2.32	3.2%
EPRP: Diabetes exams (%)	79.4	7.4	2.02	0.0	0.0	0.0	2.02	2.5%
NSQIP 2001 Mortality O/E	0.953	0.43	0.0	0.0	0.0	0.0	0.00	0.0%
Cost per unique patient	$4100	$752	0.0	0.0	0.0	0.0	0.00	0.0%

FTE indicates full-time employee, FTEE, full-time employee equivalent; EEO, Equal Employment Opportunity; EDRP, external peer review program; COPD, chronic obstructive pulmonary disease; NSQIP, National Surgical Quality Improvement Program.

level (necessitated by high multicollinearity among the aggregated individual-level factors) was high for only one of the metafactors.

The results confirm the initial hypotheses of Aim 2: positive employee perceptions of the organizational climate are associated with improved self-reported and administratively-derived measures of employee health and satisfaction and patient care outcomes, adjusting for facility response rate, size, and work organization characteristics. Further, the minimal differences between models built with the full AES data set and the subset of clinically-related respondents suggests that these associations are primarily related to the overall organizational climate of the facilities, not just local or workgroup climate. The associations appear generally stronger with subjective (AES-derived) characterizations of outcomes than with outcomes from administrative data sets, suggesting some "common instrument bias." However, within the survey, the striking difference in R^2 between models built on AES attitudinal outcomes and those built on AES health and safety outcomes suggests a degree of unbiased reporting.

The differing associations of patient satisfaction and EPRP measures are intriguing. Patient satisfaction measures are positively related to the Support metafactor, while the EPRP measures of preventive and chronic care are associated with the Employee Focus construct. This may be a function of the distinction between two aspects of care quality: interpersonal and technical.[47–49] Patient satisfaction is considered a measure of interpersonal care quality and may itself be more strongly related to the interpersonal aspects of the work environment and how coworkers relate to each other in public. EPRP data, objective measures of technical care delivery, may be more strongly related to the broader structural and leadership characteristics assessed by Employee Focus.

The calculations of potential system savings due to improved organizational characteristics (Aim 3; Table 4) are highly theoretical, due to the complexity of these interrelationships. They assume that all other constructs in the models are unchanged; in the real world, interventions aimed at organizational improvement would probably alter the work organization variables as well, perhaps resulting in increased savings. Unmeasured confounders undoubtedly affect these relationships, and unanticipated changes in these could result in increased or decreased savings.

Some associations of increased Professional Demands are at first glance counterintuitive, in particular, those with reduced nonclinical sick leave and improved inpatient satisfaction. Rather than assuming that harder-driven employees generate better results, a more nuanced understanding of stress and "Professional Demands" may be necessary in health care. "Demands" may have a very different meaning in a health care context than in industry and other sectors, as it may reflect intellectual and patient care challenges, the primary reasons clinicians

choose their field. This suggests that the manufacturing stress model of job demands may be inadequate for the health care work environment. Measures of work demands and role conflict (the components of the Professional Demands metafactor) may therefore be measures of an exciting, challenging, and effective work environment, even as they correlate with increased stress and turnover intent. However, the low reliability of the Professional Demands climate metafactor and its component Role Conflict scale (at the individual level) suggest these results be interpreted with caution.

An alternate hypothesis would propose that workers in high demand situations have limited choice and must reduce sick absences, while their higher workload results in better care. These hypotheses also draw attention to a possible difference between short-term and long-term outcomes associated with increased demands and role conflict[50,51]; this study was unable to analyze long term results. Note that Pay Satisfaction is also positively associated with stress, even as it demonstrates a strong negative relationship with turnover intention. Clearly, qualitative data is needed to understand the subtleties of these relationships.

Despite these ambiguities, this study provides evidence that the theoretical models referenced earlier[32,34–36] should be expanded to include more nuanced constructs related to work Demands. These workplace variables represent an important pathway through which organizational characteristics are manifested at the job level.

While focusing on the measurable aspects of organizational climate and policies, this study also provides contradictory information about measures of work organization. Work hours, shift work characteristics, mandatory overtime, and floating have weaker and more complicated (sometimes counterintuitive) relationships with outcomes, compared to the organizational perceptions that compose the climate metafactors. Many of the "benefits" associated with seemingly negative (for employees) work organization characteristics may be the result of reduced employee costs (eg, increased working hours and floating are associated with reduced cost/patient); better continuity of care (eg, more mandatory overtime and shift rotations are associated with improved EPRP measures); or with structural impediments to reporting and fear of retribution (eg, more mandatory overtime is associated with reduced EEO claims). However, some have clear implications for efforts at structural prevention (eg, the strong relationships of longer working hours and especially shift work with assault rates).

Strengths

The strengths of the study include the large size of the survey database, the integration of a broad range of administrative outcomes measures that are unrelated to the survey and not formally available to employees (hence eliminating the possibility of common instrument bias in those models), and the substantial variance in all measures that improves the ability of models to separate effects of the independent variables. The congruence between models explaining variance in the administrative measures and within-survey models helps validate the relationships that are based solely on self-report. In addition, the initial entry of work organization variables into the models is the most conservative approach to estimating associations of the climate metafactors. Indeed, because work organization variables can be one pathway through which organizational culture affects working conditions and outcomes, possibly this method represents an overadjustment, and that the true associations between organizational climate and outcomes is stronger.

Weaknesses

The cross-sectional nature of the study prevents the simple determination of causality. However, because of the hierarchical nature of these measures, and because most outcome data are in the administrative data sets whose formal content is unknown to employees, it is possible to favor some causal inferences. For example, it is highly unlikely that high levels of patient satisfaction (assessed by confidential questionnaire) would influence employee perceptions of support from the organization.

Several factors may result in actual associations being stronger or weaker than those calculated here: 1) Unmeasured confounding factors undoubtedly exist, such as geographic and regional characteristics of employees, patients, and facility infrastructure. If such factors exist, interventions will not have the benefits predicted from the associations calculated here. Follow-up survey plans are under way to examine this. 2) Random error (nondifferential misclassification of exposure or outcome, or both) will always bias measures of association to the null hypothesis (ie, weaken results). Therefore, the associations could be stronger than calculated here, and greater benefits might accrue from interventions than predicted. Finally, 3) all identified statistical associations in a given data set are mathematical "predictions." Confidence intervals at a future point in time are substantially wider than are those in current relationships. Although the magnitudes of estimates may not change, their variability becomes far greater, and the size of hypothesized benefits may differ in either direction.

The survey had a response rate of only 37% (range among facilities, 9% to 92%). Because of constraints on follow-up, survey subcontractors were unable to increase response rate or to characterize any differences between responders and nonresponders. Although such response rates are considered adequate for organizational intervention, some caution around generalizability to other populations is appropriate. However, analyses did adjust for response rate, which was positively associated with positive organizational assessments.

Data collected for organizational purposes may not have the quality assurance or data integrity systems that one would desire in research databases. Data entry errors are common in all systems. Although some may be corrected through the careful construction of outlier warnings, errors within levels of tolerance cannot be identified or their magnitude estimated. Furthermore, data collected for specific organizational purposes may not be fully compatible with definitions desired in research. For example, "full-time employee equivalents (FTEE)" is a well-defined entity, but contractors, students used as employees, and temporary workers (all excluded from the AES) may increase the true denominator of individuals working. Similarly, "unique patients" may actually shift from one hospital to another in the course of the year, so that their movement changes denominators. If outcomes (such as patient satisfaction) are associated with such movement, exposure misclassification may result.

Finally, because the survey-assessed exposures and outcomes were collected in the same questionnaire, responses may be subject to common instrument bias: a respondent's self-assessed outcome may influence the report of exposures, or vice versa. Interestingly, the four climate metafactors were strongly associated with the four self-reported attitudinal outcomes (overall satisfaction, care quality, stress and turnover intention), but they did not enter strongly in models explaining the five self-reported health and safety outcomes, suggesting minimal common instrument bias in this aspect of the study. And the extensive use of administrative outcomes measures, unconnected to the AES, protects models explaining variance in these outcomes from common instrument bias.

Conclusion and Recommendations

The relationships examined in this study are complex but do point to opportunities for intervention. To the degree that our measures of organizational climate reflect the underlying culture of the hospitals, the results suggest that changes in organizational culture and policies, as well as work organization, may have substantial benefits for employees, patients, and system performance. Estimated savings to the system (Table 4) suggest that these interventions should be cost-effective. Because these data arise from the largest integrated health care delivery system in North America, they may have broad applicability to other health care settings.

The variance in organizational measures over the VHA system requires intervention strategies to be facility specific. While being responsive to local conditions, the research suggests the most effective interventions would be those that improve leadership's attention to employee well being and support, while moderating demands and clarifying roles. As in most workplaces, increased pay is not a negative. Both cultural and work organization changes are complicated and require detailed attention to their intended and unintended consequences.

Future research in this area will explore the hypotheses generated by this cross-sectional study. We plan longitudinal studies to help establish causal direction of these relationships. Intervention studies, in particular, are planned to test our estimates of system performance change potential. Finally, the authors will analyze existing qualitative data (in databases from interventions completed by the National Center for Organizational Development) to explore the meaning of the survey measures to respondents and begin to unravel the complexities of these relationships.

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